This listing of claims will replace all prior versions, and listings, of claims in the application.

Listing of Claims:

1 - 94. (Cancelled).

95. (Previously Presented) A quantum dot, comprising:

a nanocrystalline core exhibiting quantum confinement and having a band gap;

a luminescence promoter linked to the surface of the nanocrystalline core;

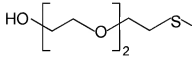
a non-zinc linking group;

an ethylene glycol unit linked to the surface of the nanocrystalline core through the linking group; and

the luminescence promoter selected from the group consisting of an ethylene glycol unit, an alkylthio acid, mercaptoacetic acid, and any combination.

96. (Previously Presented) The quantum dot of claim 95, wherein the linking group does not comprise a group VA or VIA element which is present in the nanocrystalline core.

97. (Previously Presented) The quantum dot of claim 95, comprising a group of formula XI, comprising a sulfur atom, wherein the sulfur atom is linked to the surface of the nanocrystalline core.



XI

98. (Previously Presented) The quantum dot of claim 95, wherein the nanocrystalline core comprises cadmium telluride.

99. (Previously Presented) A quantum dot, comprising:

a nanocrystalline core exhibiting quantum confinement and having a band gap;

a luminescence promoter linked to the surface of the nanocrystalline core; and

a biofunctional group linked to the surface of the nanocrystalline core,

wherein the luminescence promoter does not comprise a mercaptoalkanoic acid.

100. (Previously Presented) A quantum dot, comprising:

a nanocrystalline core exhibiting quantum confinement and having a band gap;

a luminescence promoter linked to the surface of the nanocrystalline core;

a non-zinc linking group; and

a biofunctional group linked to the surface of the nanocrystalline core through the linking group,

wherein the luminescence promoter is selected from the group consisting of an ethylene glycol unit, an alkylthio acid, mercaptoacetic acid, and any combination.

101. (Previously Presented) The quantum dot of claim 100, wherein the quantum dot is stable in aqueous solution under storage in the dark at 4 °C for at least 4 months with respect to luminescence, precipitation, flocculation, and leaching of the biofunctional group.

102. (Previously Presented) The quantum dot of claim 100,

wherein the luminescence promoter is a mercaptoalkanoic acid,

wherein the mercaptoalkanoic acid is not linked to the surface of the nanocrystalline core through a zinc atom, and

wherein the biofunctional group is not linked to the surface of the nanocrystalline core through a zinc atom.

103. (Previously Presented) The quantum dot of claim 100, wherein

the luminescence promoter is mercaptoalkanoic acid,

the mercaptoalkanoic acid is not linked to the surface of the nanocrystalline core through a group VA or VIA element which is present in the nanocrystalline core, and

the biofunctional group is not linked to the surface of the nanocrystalline core through a

group VA or VIA element which is present in the nanocrystalline core.

104. (Previously Presented) The quantum dot of claim 100, wherein the luminescence promoter comprises a non-zinc linking group and an ethylene glycol unit linked to the surface of the nanocrystalline core through the linking group.

105. (Previously Presented) The quantum dot of claim 100, wherein the linking group does not comprise a group VA or VIA element which is present in the nanocrystalline core.

106. (Previously Presented) The quantum dot of claim 100, further comprising a substantially zinc-free shell layer overcoating the nanocrystalline core.

107. (Previously Presented) The quantum dot of claim 106,

the shell layer comprising cadmium sulfide and/or mercury sulfide; and

the nanocrystalline core comprising a material selected from the group consisting of cadmium telluride, cadmium selenide, mercury telluride, mercury selenide, and/or any combination of these.

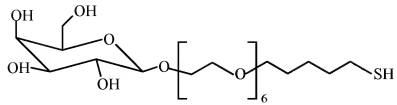
108. (Previously Presented) The quantum dot of claim 106,

comprising a group of formula XXX, comprising a sulfur atom,

wherein the sulfur atom is linked to the surface of the nanocrystalline core,

wherein the shell layer comprises mercury sulfide, and

wherein the nanocrystalline core comprises mercury telluride and/or mercury selenide.



XXX

109. (Previously Presented) The quantum dot of claim 100, wherein the biofunctional group comprises at least one biofunctional unit which is not a peptide.

110. (Previously Presented) The quantum dot of claim 100, the biofunctional group comprising a biofunctional unit selected from the group consisting of a monosaccharide unit, a mononucleoside unit, a mononucleotide unit, a monopeptide unit, a glycopeptide unit, and any combination of these.

111. (Previously Presented) The quantum dot of claim 100, the biofunctional group comprising a biofunctional unit comprising a lipid unit and/or a glycolipid unit.

112. (Previously Presented) The quantum dot of claim 110, the biofunctional group not comprising mannose or dextran.

113. (Previously Presented) The quantum dot of claim 100, the biofunctional group comprising at least one tumor-associated carbohydrate.

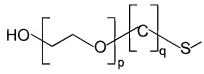
114. (Previously Presented) The quantum dot of claim 100, wherein the biofunctional group comprises a Thomsen-Friedenreich disaccharide.

115. (Previously Presented) The quantum dot of claim 114, that selectively complexes to endothelial cells.

116. (Previously Presented) The quantum dot of claim 114, that is substantially retained by agarose-bound galactose specific peanut agglutinin and that is not substantially retained by agarose-bound mannose/glucose-specific *Pisum savitum* agglutinin.

117. (Previously Presented) The quantum dot of claim 100, comprising an ethylene glycol thiol

of formula XIII comprising a sulfur atom,



XIII

wherein the sulfur atom is linked to the surface of the nanocrystalline core, p is a positive integer, and q is an integer of at least two.

118. (Previously Presented) The quantum dot of claim 104, comprising a branched linked chain comprising the ethylene glycol unit.

119. (Previously Presented) The quantum dot of claim 100, comprising a carboxylic acid unit linked to the surface of the nanocrystalline core.

120. (Previously Presented) The quantum dot of claim 100, comprising:

an ethylene-glycol-containing linked chain; and

a biofunctional-group-containing linked chain,

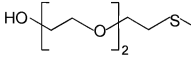
wherein the ethylene-glycol-containing linked chain does not comprise a biofunctional group and

wherein the biofunctional-group-containing linked chain does not comprise an ethylene glycol unit.

121. (Previously Presented) The quantum dot of claim 120, wherein the ethylene-glycol-containing linked chain comprises from 3 to 6 ethylene glycol units.

122. (Previously Presented) The quantum dot of claim 100, comprising:

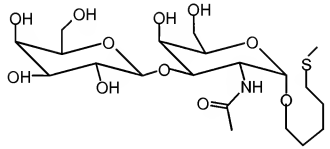
an ethylene-glycol-containing linked chain of formula XI, the sulfur atom of the ethylene-glycol-containing linked chain of formula XI linked to the surface of the nanocrystalline core; and



XI

a biofunctional-group-containing linked chain of formula XXVIIa, comprising a Thomsen-Friedenreich disaccharide as the biofunctional group and five carbon atoms and a sulfur atom,

wherein the sulfur atom of the biofunctional-group-containing linked chain of formula XXVIIa is linked to the surface of the nanocrystalline core.



XXVIIa

123. (Previously Presented) The quantum dot of claim 100, comprising:

a biofunctional-group-containing linked chain, wherein

an ethylene glycol unit is part of the biofunctional-group-containing linked chain and

the biofunctional group is part of the biofunctional-group-containing linked chain.

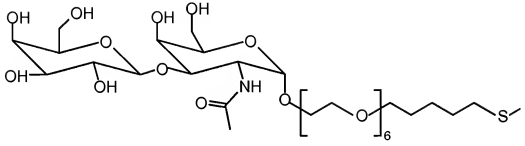
124. (Previously Presented) The quantum dot of claim 100, further comprising

a biofunctional-group-containing linked chain of formula XXVIIb,

comprising a Thomsen-Friedenreich disaccharide as the biofunctional group and

comprising six ethylene glycol units, five carbon atoms, and a sulfur atom,

wherein the sulfur atom of the biofunctional-group-containing linked chain of formula XXVIIb is linked to the surface of the nanocrystalline core.



XXVIIb

125. (Previously Presented) A formulation comprising:

a liquid; and

the quantum dot of claim 100,

wherein the quantum dot is dissolved or suspended in the liquid.

126. (Previously Presented) The quantum dot of claim 100, that is stable in aqueous solution under storage at room temperature in ambient lighting for at least 4 months with respect to luminescence, precipitation, and flocculation.

127. (Previously Presented) A method of imaging, comprising:

providing the quantum dot of claim 100;

contacting the quantum dot with a biological material;

exposing the biological material to light having a wavelength effective to cause the quantum dot to luminesce; and

imaging the luminescing quantum dots.

128. (Previously Presented) The method of claim 117, wherein the biofunctional group exhibits high affinity to tissue in a diseased or abnormal state, and the quantum dot luminescence images the tissue.

129. (Previously Presented) The method of claim 118, the diseased or abnormal state being cancerous.

130. (Previously Presented) A method of therapy, comprising:

providing the quantum dot of claim 6; and

contacting the quantum dot with a biological material and thereby treating a disease.

131. (Previously Presented) The method of claim 100, the biofunctional group comprising an immune-response stimulating group.

132. (Previously Presented) The method of claim 100, the biofunctional group comprising a tumor-ssociated antigen.

133. (Previously Presented) The method of claim 100, wherein the quantum dot further comprises a therapeutic agent linked to the surface of the nanocrystalline core.

134. (Previously Presented) The method of claim 100, wherein a shell layer and/or the nanocrystalline core comprises a therapeutic agent.

135. (Previously Presented) A quantum dot coated device, comprising the quantum dot of claim 100 linked to the surface of the device to form a coating on the device.

136. (Previously Presented) A cell-quantum dot complex, comprising:

a cell; and

the quantum dot of claim 100,

wherein the biofunctional group is complexed with the cell.

137. (Previously Presented) A method for producing a quantum dot, comprising:

providing a luminescence promoter;

refluxing the luminescence promoter with a group IIB element salt, a hydrogen-alkali-group VIA element compound, and a suitable solvent to produce a quantum dot in a solution,

wherein the luminescence promoter is selected from the group consisting of an ethylene glycol unit, an ethylene glycol thiol, an alkylthio acid, mercaptoacetic acid, and any combination of these.

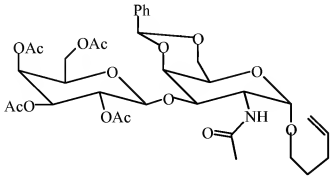
138. (Previously Presented) The method of claim 137, comprising:

providing a biofunctional group-thiol, comprising a biofunctional unit; and

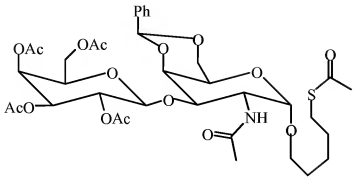
refluxing the biofunctional group-thiol and the luminescence promoter with a group IIB element salt, a hydrogen-alkali-group VIA element compound, and a suitable solvent to produce a quantum dot in a solution.

139. (Previously Presented) The method of claim 138, comprising:

reacting a glycoside of formula IV with an alkylthio acid in the presence of 2,2'-azobisisobutyronitrile in 1,4-dioxane at about 75° C to produce a thioester of formula V;



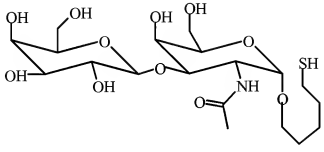
IV



V

debenzylidinating the thioester of formula V;

hydrolyzing the debenzylidinated thioester of formula V to produce a Thomsen-Friedenreich-thiol of formula VI; and



VI

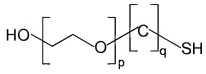
refluxing the Thomsen-Friedenreich-thiol of formula VI with cadmium perchlorate, a luminescence promoter, hydrogen sodium telluride, and a suitable solvent, to produce a Thomsen-Friedenreich-functionalized quantum dot in a solution,

wherein the suitable solvent comprises water and/or N,N-dimethylformamide.

140. (Previously Presented) The method of claim 137,

wherein the luminescence promoter comprises an ethylene glycol thiol,

wherein the ethylene glycol thiol is of formula XIII, and



XIII

wherein p is a positive integer and q is an integer of at least two.

141. (Previously Presented) The method of claim 137,

wherein the group IIB element salt is cadmium perchlorate and

wherein the hydrogen-alkali-group VIA element compound is hydrogen sodium telluride.

142. (Previously Presented) The method of claim 137, wherein the suitable solvent comprises water and/or N,N-dimethylformamide.

143. (Previously Presented) The method of claim 138, further comprising:

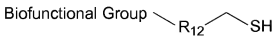
reacting a glycoside of formula XVIII with an alkylthio acid in the presence of a catalyst to produce an acetylated, benzylidenated biofunctional group thiol of formula XIX;

XVIII

XIX

debenzylidenating the thioester of formula XIX; and

hydrolyzing the thioester of formula XIX to produce the biofunctional group-thiol of formula XVb,

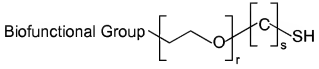


XVb

wherein R_{12} comprises a carbon atom and R_{13} comprises a carbon atom.

144. (Previously Presented) The method of claim 138,

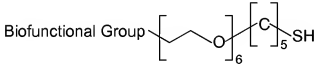
wherein the biofunctional group-thiol comprises a thiol of formula XVIb and



XVIb

wherein r is a positive integer and s is an integer of at least two.

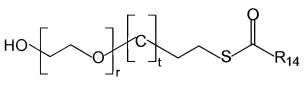
145. (Previously Presented) The method of claim 138, wherein the biofunctional group-thiol comprises a thiol of formula XVIIb.



XVIIb

146. (Previously Presented) The method of claim 138, further comprising:

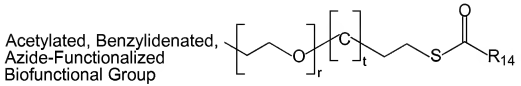
reacting a compound comprising ethylene glycol of formula XXb



XXb

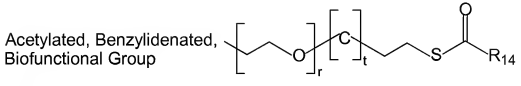
with a glycoside having azide and a group of formula XXbb as pendant groups and quenching the reaction with triethylamine to produce a compound of formula XXIIIb;

XXbb



XXIIIb

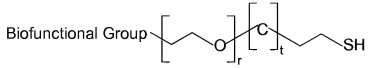
treating the compound of formula XXIIIb with acetic anhydride and a reducing agent to produce a compound of formula XXIIIc in which the azide group of formula XXIIIb is replaced with an acetamido group;



XXIIIc

debenzylidenating the compound of formula XXIIIc; and

hydrolyzing the compound of formula XXIIIc to produce the biofunctional-group thiol of formula XXIVb,



XXIVb

wherein r is a positive integer, t is zero or a positive integer, and R_{14} comprises a carbon atom.

147. (Previously Presented) The method of claim 146, wherein the group IIB element salt is cadmium perchlorate,

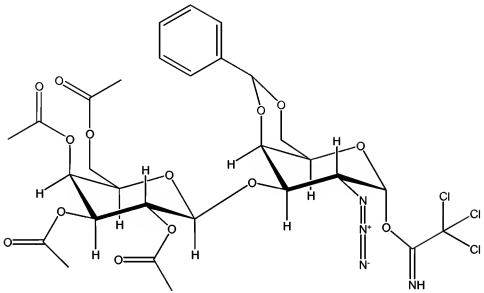
wherein the hydrogen-alkali-group VIA element compound is hydrogen sodium telluride,

wherein r is six and t is three,

wherein R_{14} is methyl,

wherein the glycoside having an azide and a group of formula XXbb as pendant groups has formula XXII,

XXbb



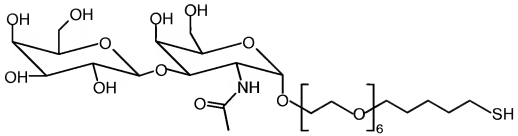
XXII

wherein the reducing agent is zinc,

wherein the debenzylidenating comprises treatment with acetyl chloride and quenching with pyridine;

wherein the hydrolyzing comprises treatment with sodium methoxide and quenching with ion-exchange resin, and

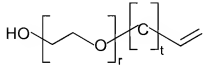
wherein the biofunctional-group thiol is of formula XXIVc.



XXIVc

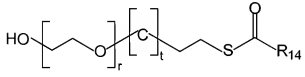
148. (Previously Presented) The method of claim 146, further comprising:

reacting a polyethylene glycol with sodium hydroxide and a brominated alkene to produce a compound of formula XXa; and



XXa

reacting the compound of formula XXa with an alkylthio acid in the presence of a catalyst to produce a compound of formula XXb,



XXb

wherein r is a positive integer, t is zero or a positive integer, and R_{14} comprises a carbon atom.

149. (Previously Presented) The method of claim 142, comprising refluxing the biofunctional group-thiol of formula III with a group IIB element salt, a hydrogen-alkali-group VIA element compound, and a suitable solvent to produce a quantum dot in a solution,

III

wherein R_1 comprises a carbon atom and/or an ethylene glycol unit,
wherein the group IIB element comprises cadmium and/or mercury, and
wherein the group VIA element comprises tellurium and/or selenium.